Description

Acoustic pick-up

The invention relates to an acoustic pick-up, more particularly an ultrasonic pick-up for acoustically diagnosing machines, according to the preamble of claim 1.

In many areas of process and power engineering that are of relevance to safety the trouble-free operation of a system depends on the smooth functioning of the machines or machine parts employed. In order to avoid costly, erratic interruptions to operation, any damage to valves or bearings, for instance, should as far as possible be detected at the initial stage, which is to say before a component outage can bring the system to a halt. As an instance of this, defective valve seats will result in leakage flows that produce broadband ultrasonic emissions. Picking up and evaluating the ultrasonic emissions of a valve can hence serve to detect valve damage early. An ultrasonic pick-up suitable for picking up the solid-borne sound signal is known from DE 299 12 847 U1. Said pick-up has a housing containing a piezoelectric measuring element and a circuit for signal conditioning. The conditioned measurement signal can be ducted as an output signal over a cable to a remotely located evaluation device. The auxiliary power required to operate the signal conditioning circuit is supplied by the evaluation device and made available to the acoustic pick-up likewise via the cable. This means an additional device for generating the auxiliary power is required in the evaluation device and additional wires for transmitting said auxiliary power are required in the cable..

A monitoring sensor using wireless signal transmission (wireless transducer) is known from EP 1 022 702 A2, which

wireless transducer has, mounted within a housing, a piezoelectric sensing element for generating an electric monitoring signal and an electronic circuit.

The auxiliary energy required to operate the electronic circuit and for signal transmission is obtained from the electric monitoring signal.

A further monitoring system using wireless signal transmission is known from US patent specification 4 237 454.

The object of the invention is to provide an acoustic pick-up, more particularly an ultrasonic pick-up for acoustically diagnosing machines, which pick-up can function without an external auxiliary power supply and enables a measurement signal to be transmitted in a frequency range that is to be evaluated.

To achieve said object the new acoustic pick-up of the type mentioned at the start has the features described in the characterizing part of claim 1. An advantageous development of the acoustic pick-up is described in claim 2.

The invention has the advantage that the acoustic pick-up takes the power needed to operate an electronic circuit for signal conditioning from its surroundings so that said power does not have to be supplied to it over separate wires in a cable. As the acoustic pick-up generates the auxiliary power from the acoustic signal requiring to be picked up, sufficient power will always be available for operating the circuit at times when an acoustic signal exceeding a specific minimum intensity is present and a corresponding output signal has to be produced. The output signal can be transmitted to the evaluation device asymmetrically or symmetrically over a cable,

for example, or alternatively wirelessly using radio or infrared light.

The auxiliary power is generated from the electric measurement signal of the piezoelectric measuring element. This has the advantage that no further electroacoustic components will be required in addition to the actual measuring element of the acoustic pick-up.

When acoustic pick-ups are used for machine diagnosing, in particular for diagnosing valve leakage or damage to a bearing, evaluating a specific frequency range has proved in most cases adequate for obtaining a diagnostic result. It is known from, for instance, DE 199 47 129 A1 how when valve leakage is being diagnosed to distinguish between a lower spectral range in which mainly the valve's operating noises are located and an upper spectral range predominantly containing fault-generated noises in certain operating conditions. The threshold frequency between said two spectral ranges can be selected to be between 50 kHz and, for example, 200 kHz since the operating noises occur predominantly in a range below 120 kHz. A spectral range of the measurement signal above a frequency of 50 kHz is therefore evaluated for detecting faults, which range does not, however, have to begin directly at 50 kHz. Only signal components in that frequency range have to be amplified and transmitted on a wire-bound basis or wirelessly to the evaluation device. The signal supplied by the piezoelectric measuring element is especially powerful in the frequency range between 0 and 50 kHz because the signal components have a substantially greater amplitude therein. The signal components in that range can advantageously be used for generating the power required for operating the conditioning circuit. There is thus advantageously provided a frequency separating filter by means of which the electric measurement signal of the

piezoelectric element is separated essentially into an evaluation signal in a first frequency range, which signal is conditioned into a form suitable for transmitting to an evaluation device located outside the housing, and into a supply signal in a second frequency range, which signal supplies the auxiliary power required for operating the conditioning circuit. A frequency separating filter of said type furthermore offers the advantage that the evaluation signal will be falsified only slightly despite the supply signal being derived from the same electric measurement signal.

A better quality for the auxiliary power for the circuit for signal conditioning and hence a better quality for the output signal will advantageously be achieved if a device for rectifying and smoothing the supply signal is provided.

The invention as well as embodiments and advantages are explained in more detail below with the aid of the drawings illustrating an exemplary embodiment of the invention:

Figure 1 is a partial cross-sectional view of an acoustic pick-up and

Figure 2 is a block diagram of the electronic components of said acoustic pick-up.

Shown in the bottom half of Figure 1, which is to say below an axis 1, is a side view of an essentially rotationally symmetrically structured acoustic pick-up, and in the top half a longitudinal section through said acoustic pick-up.

According to Figure 1 the acoustic pick-up has a pot-shaped housing 2 furnished on its exterior with driving flats 3 for a wrench. Provided as a securing means is a threaded stem 4 that

can be turned into a corresponding threaded boring at the mounting position. The requisite starting torque can be applied by means of a wrench to ensure good coupling of the vibrations via a contact surface 5 of the housing base at the mounting position. Inside the housing base is an insulating disk 6 of the same material as that also of a piezoelectric element 7 onto which has been soldered a metal-plated side of said insulating disk 6, which side faces a sleeve section 8. Together with a sleeve section 9 and a disk spring 10, said

Claims

1. An acoustic pick-up, more particularly an ultrasonic pick-up for acoustically diagnosing machines, having a housing (2) inside which are located a piezoelectric measuring element (7, 30) for generating an electric measurement signal (31) and an electronic circuit (15, 35) by means of which the measurement signal can be conditioned into a form suitable for transmission to an evaluation device located outside the housing, wherein means (30, 34, 42) are provided by which the auxiliary power required for operating the electronic circuit (35) can be generated from the electric measurement signal (31) of the piezoelectric measuring element (30), characterized in that a frequency separating filter (32) is provided for separating the electric measurement signal (31) of the piezoelectric measuring element (30) essentially into an evaluation signal (36) in at least one first frequency range and into a supply signal (37) in at least one second frequency range separated from the first.

2. The acoustic pick-up as claimed in claim 1, characterized in that a device (42) is provided for rectifying and smoothing the supply signal (37).